

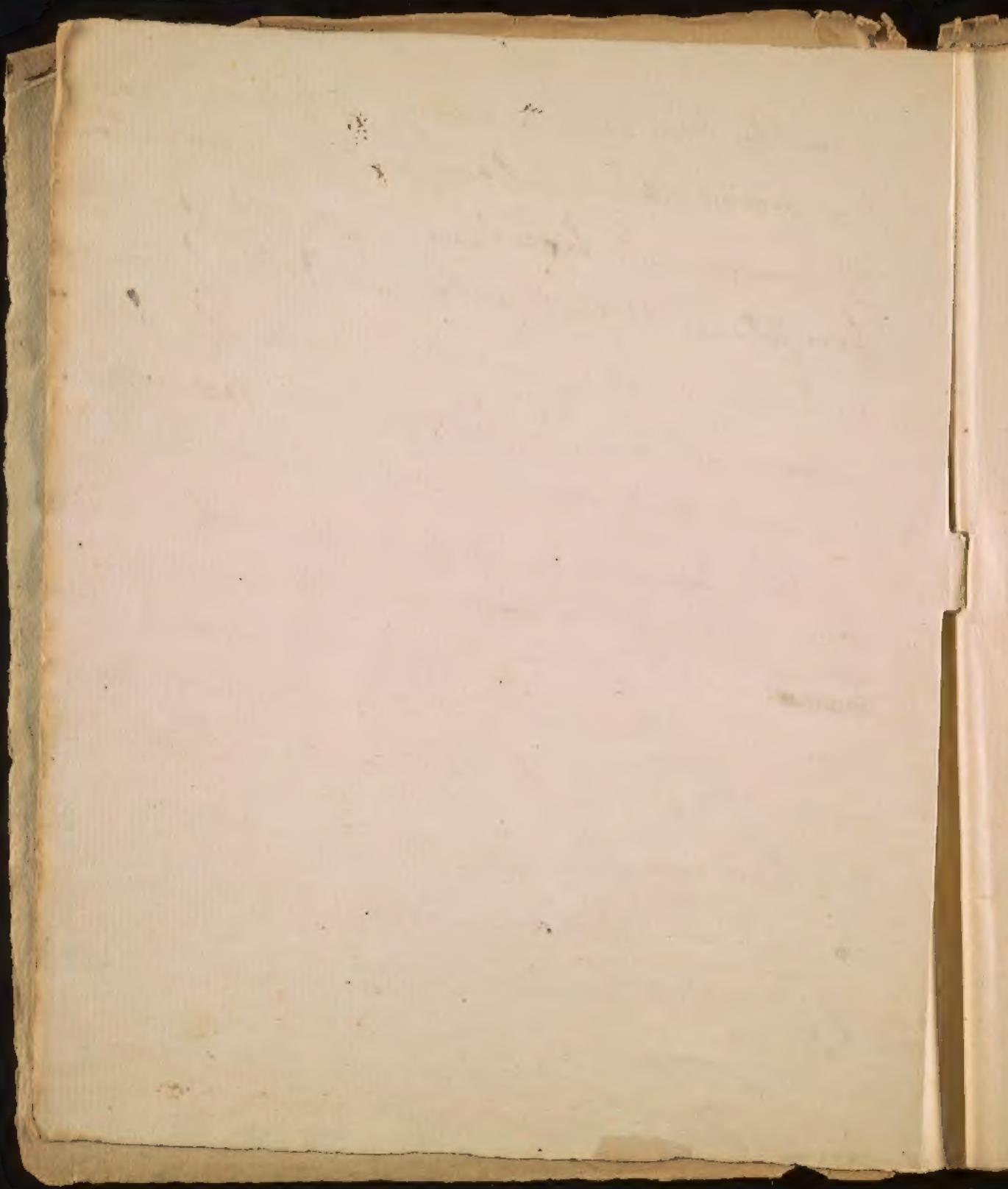
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Lecture on
animal heat.



exactly the same process. Dr Black has supposed takes place in the production of animal life but. we all carry a fire place about with us. & the Chimney which contains it is rated the Dr. supposed in the lungs. The facts which support this opinion are as follow.

1. The absolute necessity of air to animal life. There is no animal in the world that ~~lives~~ without it, whether it exist in the air - in the water, under the earth, or upon the face of the earth. Birds breath, and lest they should suffer from an inability to perform that function in their rapid flight thro' the ~~the~~ air, they are provided with cells which serve as reservoirs of



8

Air, and which probably afford them
the oxygen which supports their heat.
Even the bones of birds contain air
and probably for the purpose that has
been mentioned.

Fishes respire Air with Water by
means of their gills. They either
& die when deprived of it. Their Air
bladder may probably supply for a
while the want of external Air, al-
though the principal design of it is
to assist them in ascending & descending
in the water.

Insects which are destitute of lungs



9

and gills do not live without air.

- It is conveyed to them by means of long tubes called tracheæ or stigmata extending from different parts of the body. In some insects these tubes arise from the posterior - in others from the back and sides. If these tubes be stopped by means of oil, the insect dies from suffocation - that is from the want of air.

Worms likewise exist only in consequence of their communication with the air.

Snails die without air. When they retreat from the cold of winter,

~~whose~~
which dilatations & contractions
may be distinctly seen, and to this
tube, the Air has access. Currier
speaking of this ~~mode of~~ curious
contrivance says "the blood not being
able to go in search of Air, the Air
goes in search of the blood". —

The heat in all these classes of
animals is different. In fish it is but
2° above the temperature of the water
in which they swim. The heat
generated ~~is~~ generally in proportion

They cover their bodies with a slimy coat so thin as to admit the passage of air through it. If this coat by any accident become too thick to admit the air, they perforate it in order to make a passage for it.

~~also~~ The Toad which has been found in the ~~dead~~ middle of the trunks of trees, and in the centre of stones where it has existed for one or two centuries it is generally supposed, receives air ~~accident~~ to preserve its heat thro' the pores of the tree, and the cavities of the stone.

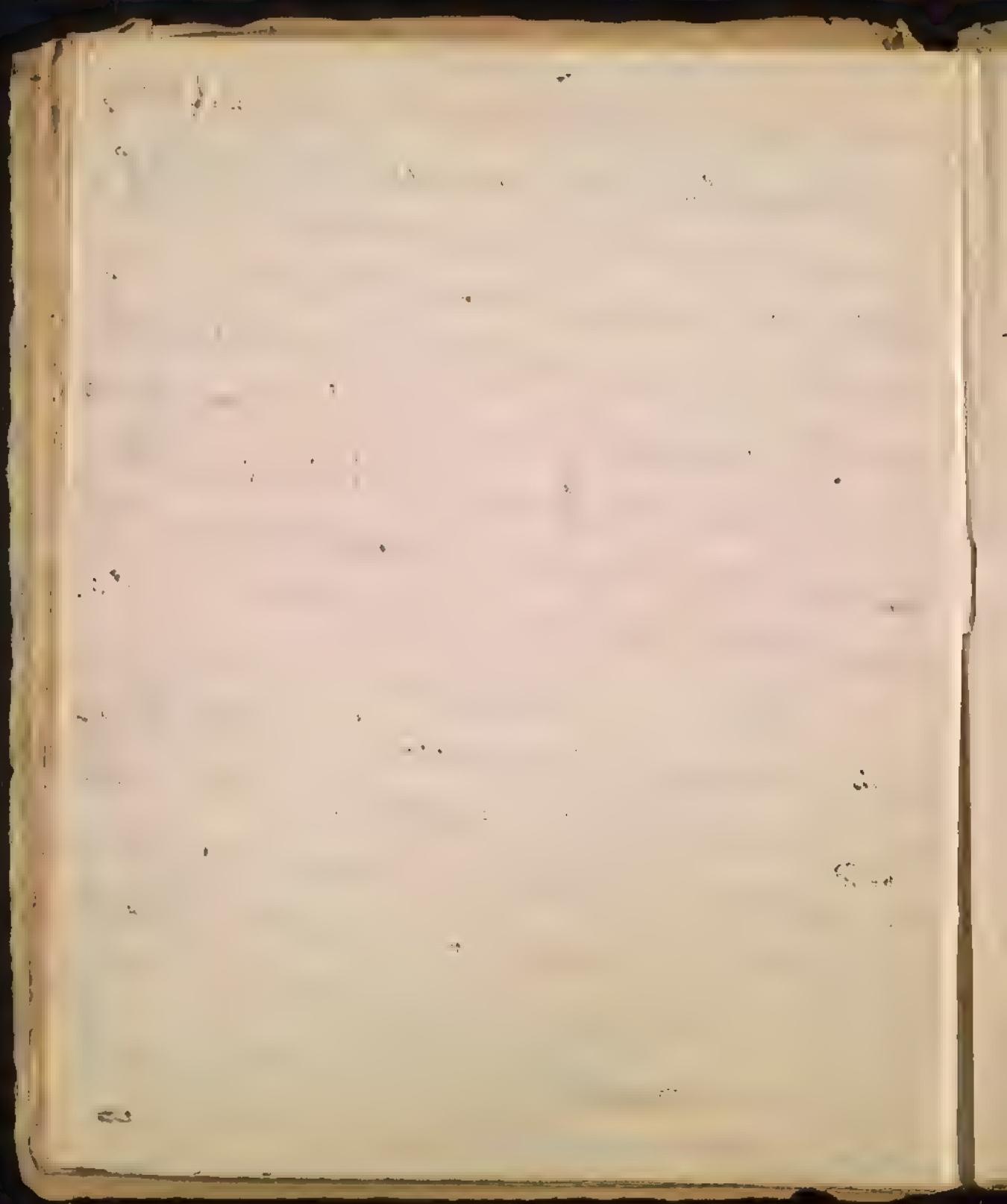
Lastly - ~~also~~ even those insects which are destitute of wings have a membranous tube running along their backs in

to the size of their lungs, and the
Quantity of Air consumed in them.

- 2 The connection of the heat of the body with the admission of air into the lungs has been inferred from the quantity of air consumed in respiration, said to be a gallon in a minute - that is 14 cubic inches according to Dr Goodwin in each inspiration, but according to Dr Jussin, & De Mervis experiments 40 cubic inches, in a minute in a heat of 88°. It is said to expand to 43 cubic inches in the lungs.
- 3 The connection of the heat of the body with the admission of air into the lungs has been adjusted from animal heat being in proportion to the quantity of air consumed in respiration, and to the size of the lungs; exclusive to the size of animals. It is 111: ~~extending~~ in birds, and they we know have larger lungs in proportion to their size than any other animal. Its animal heat is in a low degree in fish, insects, & reptiles than in man, and

many other breathing animals, and they¹²
we know have very small lungs in pro-
portion to their size, and consume but
little air in respiration. It is in a very
low degree in the toad for which rever-
end Mr. Swift informs us in his travels into
Spain, that the Spanish ladies sometimes
toads in their bosoms in order to ^{carry} lessen
heat of their bodies in hot weather.

4 - From the Change which is introduced
the Air which is discharged from the lungs
in expiration being exactly the same as
that which is produced in the Air after it
is robbed of its Caloric or matter of heat
by the combustion of a pair of wood, or
any other ~~bony~~ body. The Air we expire
is free Aristotle or phlogisticated Air & is



not only extinguishes flame, but is fatal
to animals that breath it.¹³

5 From ~~exp~~¹³ the Arctic air which is dis-
charged from the lungs being less warm
according to Dr Crawford than pure air which is
taken into the lungs.

6 From the arterial blood on which the de-
oxygenated air first acts, being warmer
by one degree & $\frac{1}{2}$ according to Dr Crawford
than venous blood. It is as $11\frac{1}{2}$ to
~~100~~¹⁰⁰ according to Mr Hunter's Arctical
Thermometer it was 99° in the right
and 97 in the left Ventricle of a dog, being
for the purpose of ~~exp~~ ascertaining this
fact by Mr Polkman.

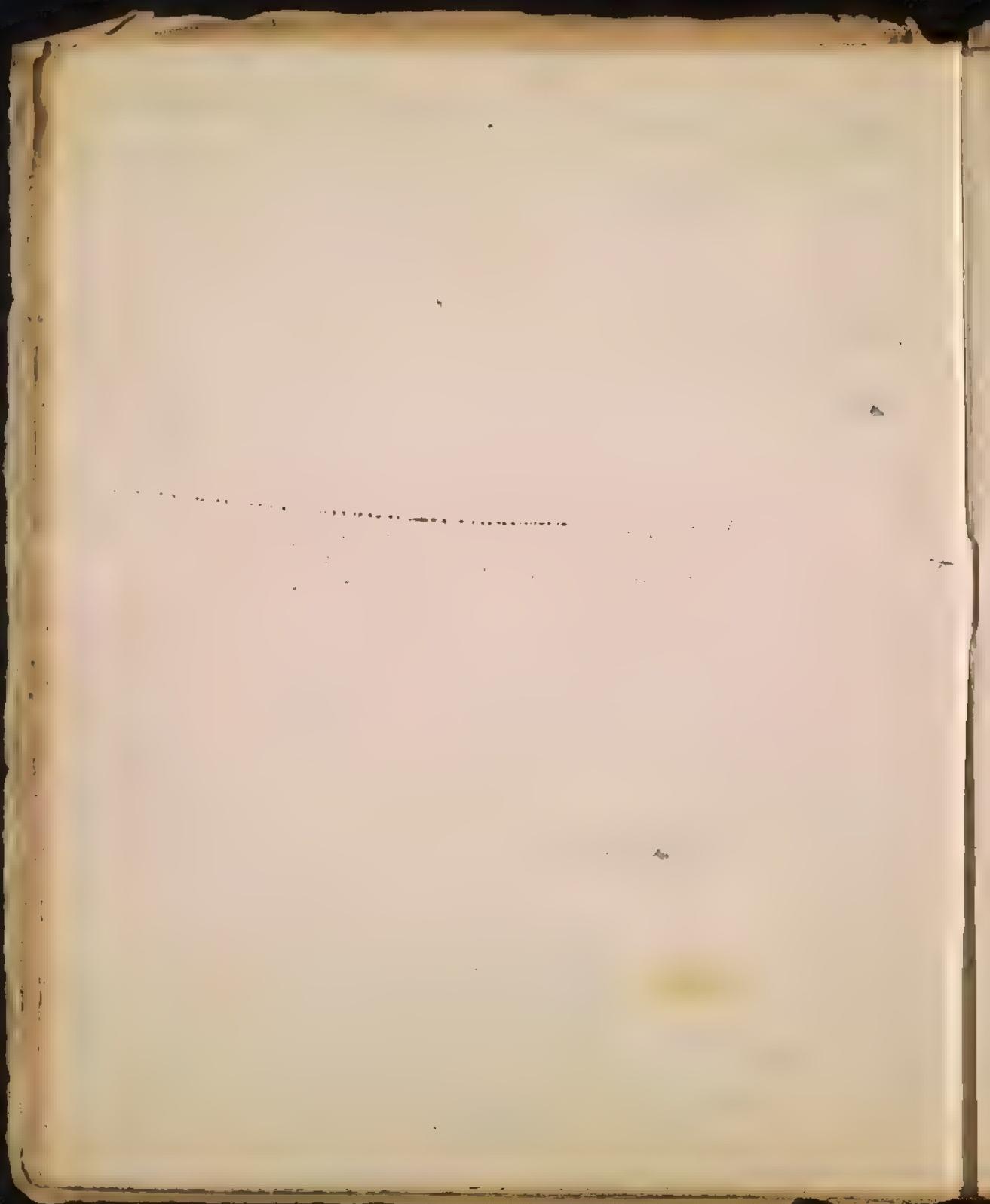
7 From ~~exp~~ the red color of the blood.
in the body after the exp of the
This

whale

whale

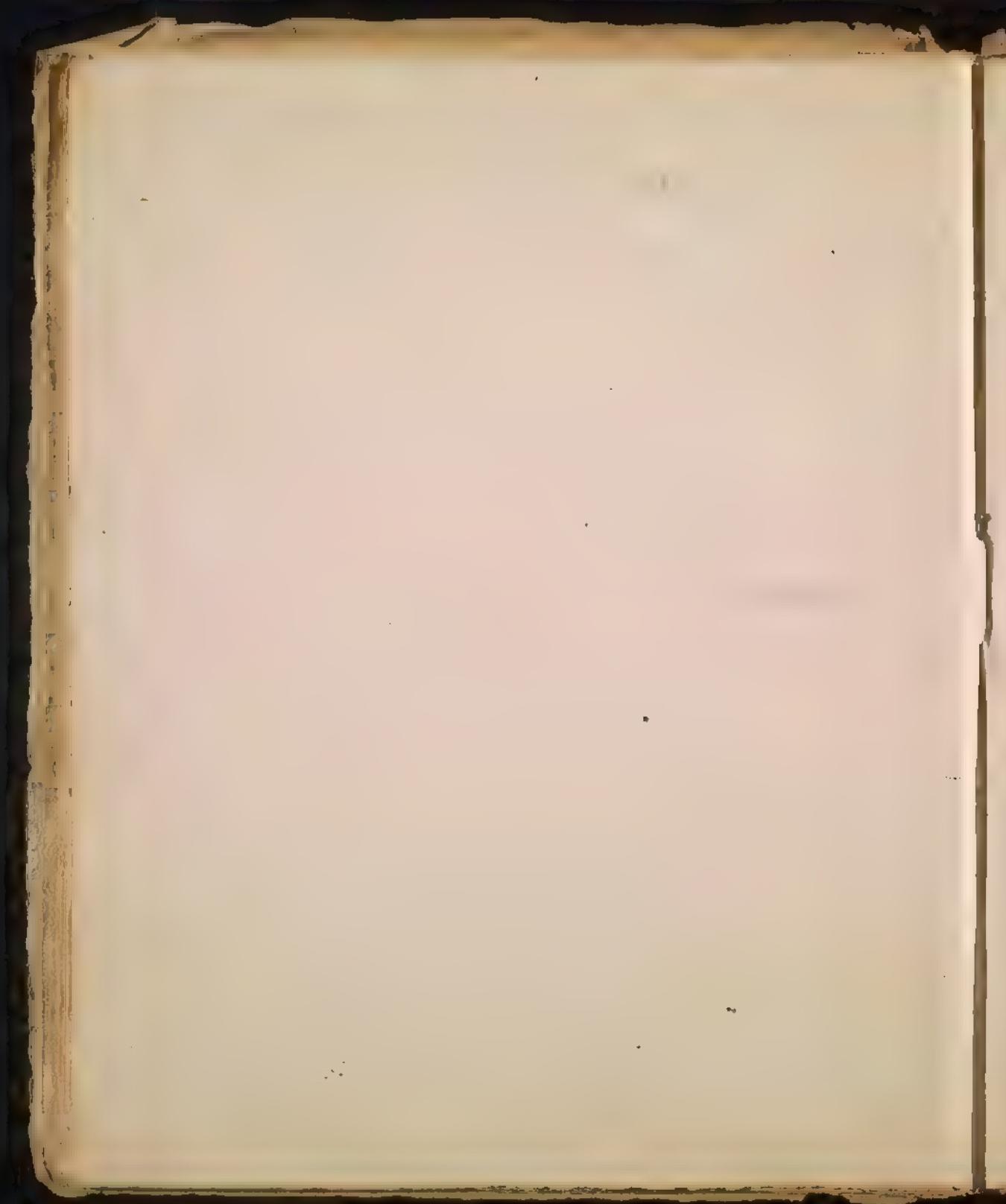
Color we know is derived from Oxygen
in the Collotheas of Vitriol, in red lead,
in horns preserved with salt petre, w:
salt abounds with Oxygen. now the
red Color of the blood is supposed to
be derived in like manner from the
action of the Air upon it in the lungs.
It is certainly much redder & in the
pulmonary vein than in the pulmo-
nary artery after the Air has acted upon
it, and much redder in an adult
than in a ^{petris} ~~baird~~ which has never breath-
ed.

& from the analogous effects of Oxygen
Air upon a burning body, and upon the
lungs. The more of this Air that can



be applied to a burning body, the more
vivid is the flame emitted by it, and
the greater is its heat. In like manner,
the more of this air that is received into
the lungs, the greater the generation of
heat - and hence - the increased heat of
the body in a fever & after exercise.

In ~~the~~ favor of the cause of animal
heat which has been delivered, an attempt
has been made to explain ^{that} passage in the
book of Job in which he describes the act
of Respiration in the Leviathan "By his
noses a light doth shine, and his eyes
are like the eye lids of the morning. Out
of his mouth go burning lamps, &
Sparks of fire leap out. Out of his



16

Nostrils goeth smoke, as out of a
Leathirg pot, or chadron. His breath
kindleth Coals, and a flame goeth out
of his mouth". From ~~this history of~~
~~the matter~~ ^{that} discharged from the nostrils
of things of the Leviathan it doth in
a state of inflammation, it has been
said is produced by the decomposition of
dry ~~genus~~ such as goes forward in a
cubinary fire. —

Simple and beautiful as this theory ~~is~~
appears, to be, there are several solid objections
to its being the sole, or exclusive cause of
animal heat. I shall briefly mention those
objections.

The heat of the body, has been observed to
be the same, when the admission of air

"medicin legale" mentions a case in
which the heat of the body continued
four days after death had taken place.

17

into the lungs has been presented by Dr. Moore
to the Museum at Philadelphia. One of the latter
lungs is now exhibited in the Museum. A ~~specimen~~
specimen ~~was~~ was received in Philadelphia July 5. 1811.
a man ~~who~~ in whom there was a total
obstruction of ~~the~~ the lungs from smoking cold
water when he was very young. His ~~lungs~~
~~had~~ had to be cut up ~~and~~ and only
left four bones after his ~~removal~~ removal
declined to death. Dr. Horner in his
& the like of a lung is sometimes seen
engulfed after the generation ~~of~~ for ~~the~~

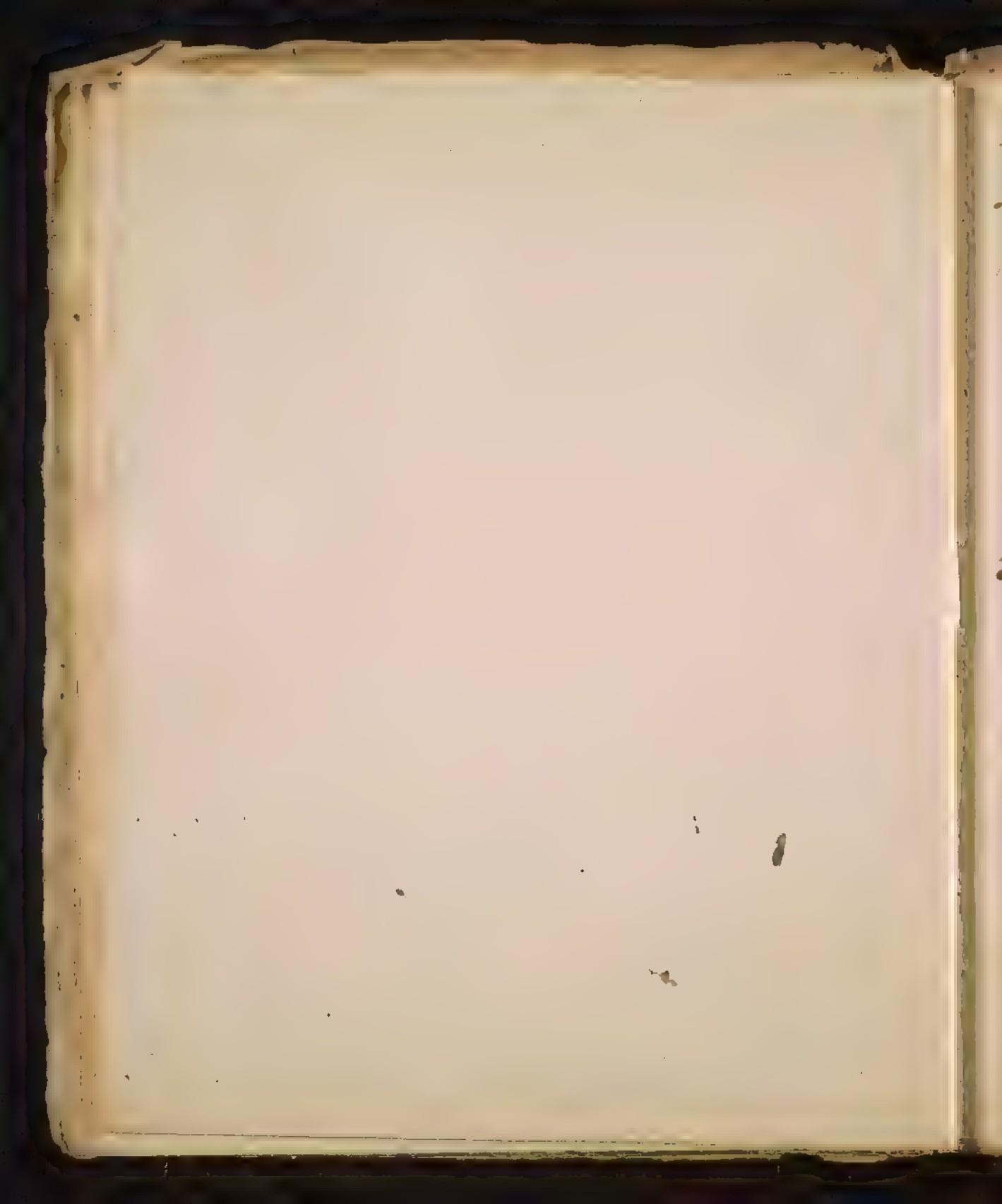
Inflammation whereby the passage of the blood
which ~~is~~ supposed to convey the heat genera-
-ting in the lungs to every part of the body,
~~which~~ is completely obstructed. I witnessed a
most remarkable case of this kind in Dr. Morey,
from 1811 in



18

A patient of Dr. Ryck. The heat was
much greater in the lamb on which the
operation had been performed, than in its
~~successors~~ fellow, & was so long before
it was possible to ~~see~~ ^{feel} the
transfusing vessels to ~~see~~ ^{feel} the
function of the large artery that had
been suddenly ligated and divided, and that
had just before conveyed a ^{large} mass of blood
to the lamb. Ask from whence in this
case did the lamb receive its extra supply
of heat?

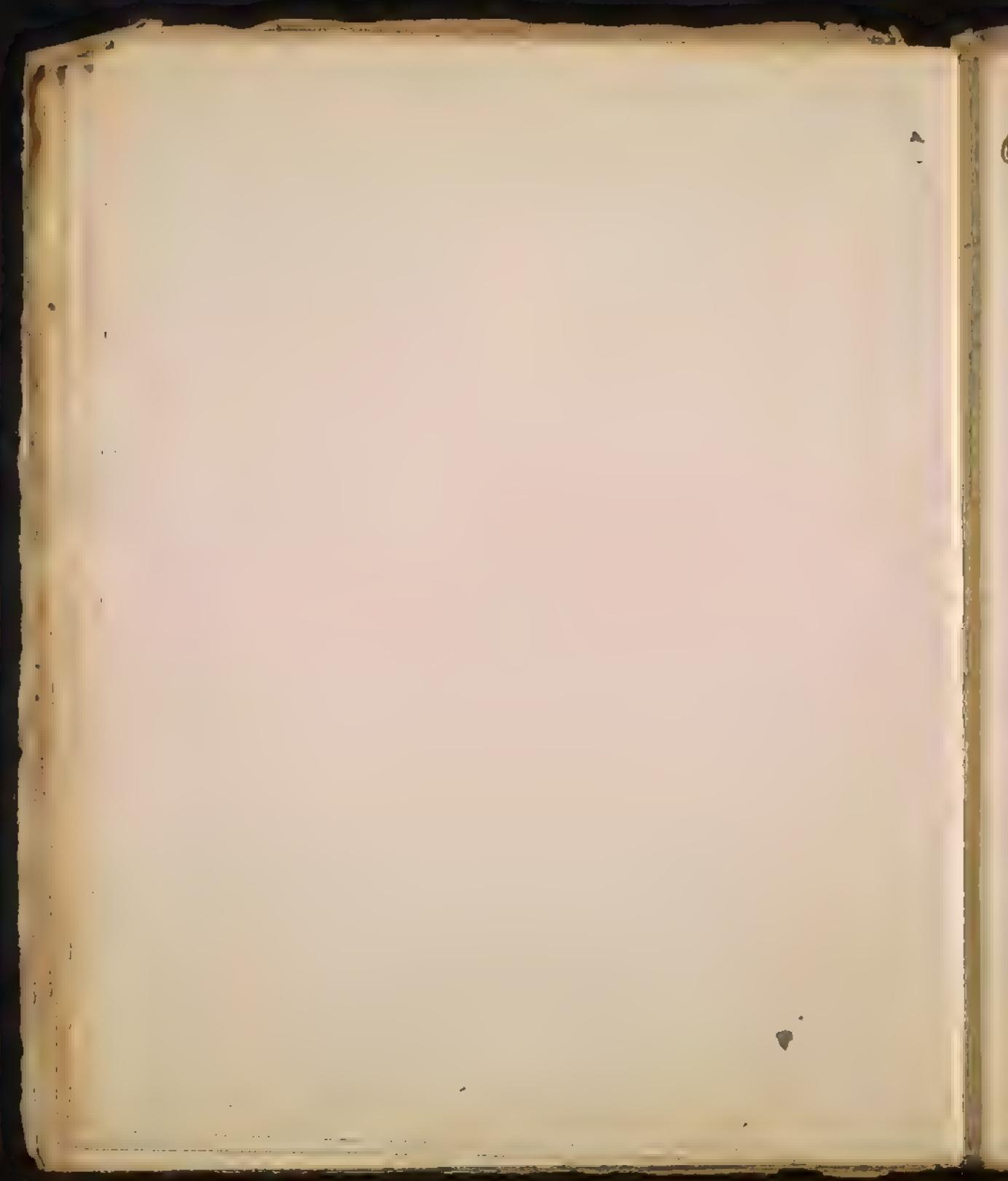
3. The heat of the body is often dependent
on the number of ~~parts~~ the pulse, or the
force or quantity of the blood propellid
into ~~the~~ every part of it. We observed
the skin to be very hot when the pulse
is at 100, ~~and~~ and the ~~heat~~ ^{fever} ~~cesses~~



19

the hottest skin I ever felt was ~~to~~ ^{in a} in a
Sailor in a yellow fever in which the
pulse was imperceptible in both his wrists.
The heat of the body is diminished in old
age and yet the people continue, and continue
as much as they did in their
youth.

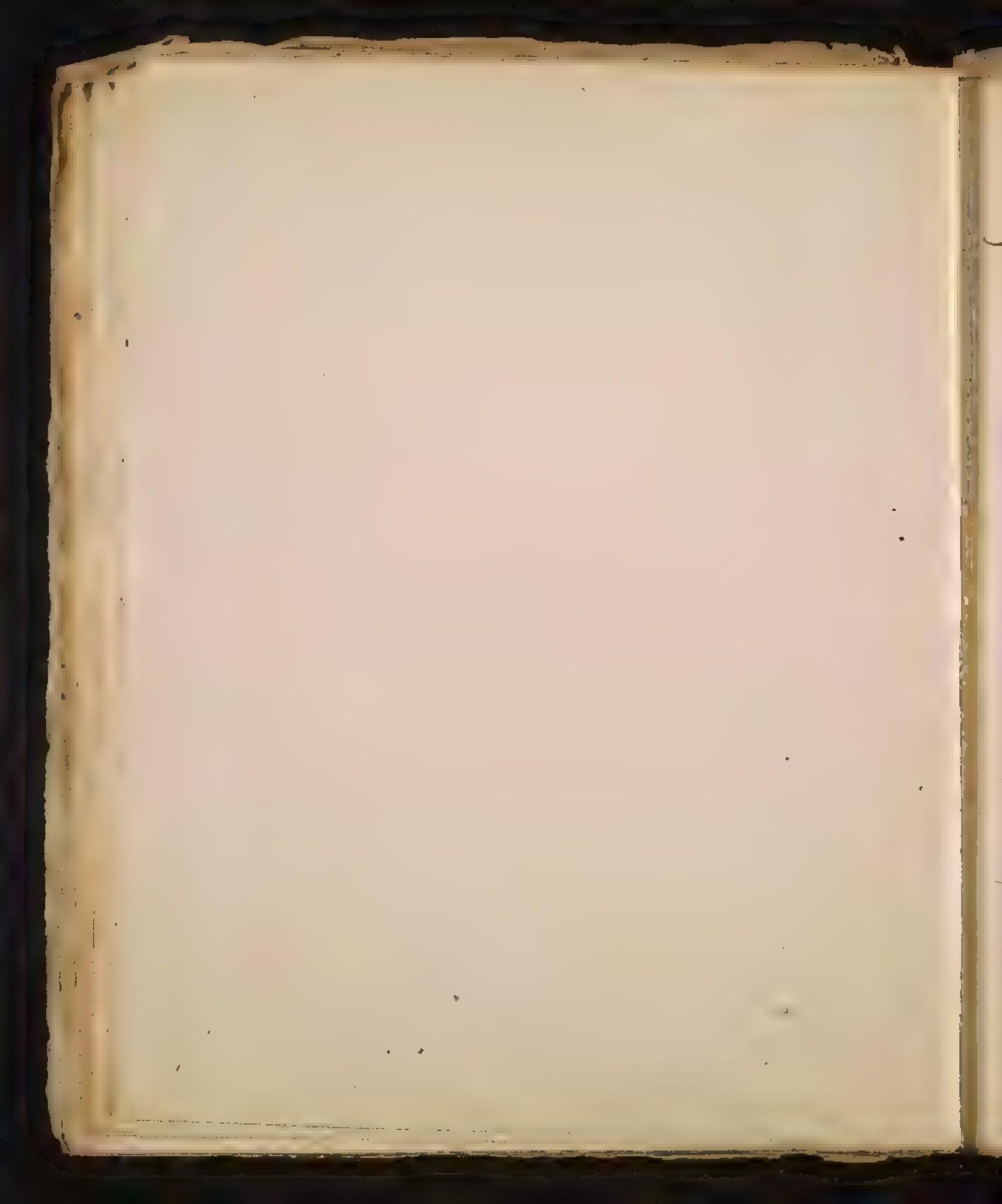
There is sometimes a passage of motion
from without any diminution of heat. This
was without doubt the fault in Mr.
and Mrs. Weston. Both their health is failing
but the heat of their bodies continues
as it did in a case of
fever. The heat it is said is a case of
heat left his health by the
heat of his body so far from being
diminished, is greatly increased. The pants only
opened at the end of the nose and never in his
course.



There is often a partial & violent sensation of heat in the extremities while the parts between them, and the lungs are cool or cold. This would not be the case if the lungs were the only and exclusive source of the heat of the body.

If the heat of the body is but one degree greater in the lungs than in parts remote from them, more than the 1^o 50^o the first place in which the heat of the body was exclusively generated, it ought to be more than one degree greater than in the extremities.

If certain Abiments and Drinks increase the heat of the body without acting in the smallest degree upon respiration, or increasing the decomposition of Air in the

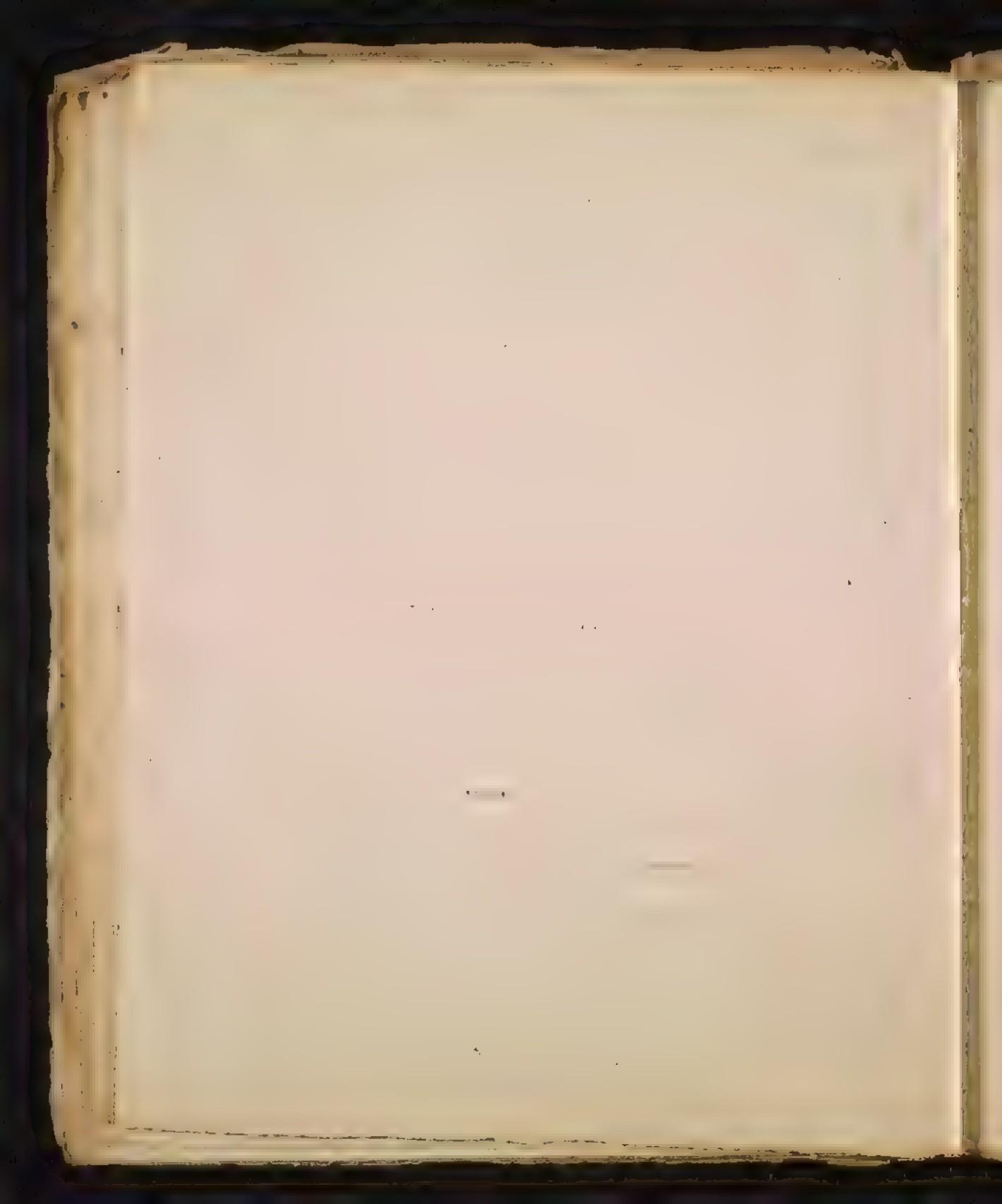


lungs.

9 Certain Sounds increase the heat of the body. This has often ^{been} experienced after the firing of cannon & now as it is cool, no additional decomposition of Air takes place in the lungs for there is no increase of respiration.

10 Light increases the heat of the body. This is often experienced on a hot evening in summer when a candle ^{is} suddenly held into a dark room. No one can suppose ~~Coldness~~ in this case more air to be taken into the lungs or a ~~less~~ sudden decompo-
sition of ~~water~~ an increased quantity of air to have taken place in them.

11 Certain vapors increase the heat of the body without the least influence upon respiration or the decomposition of Air in



Mr. Lee says:

I have attempted year after year to explain these facts so as to reconcile them to the theory of my illustrations made by Black, but I have never been fully satisfied with my solutions of them. I am compelled therefore to reject the due decomposition of Ag_2O in the long and the exclusive cause of permanent heat, and to call in a additional cause for that purpose, which I shall now submit to your examination. I shall begin by delivering a few general propositions.

proportions.

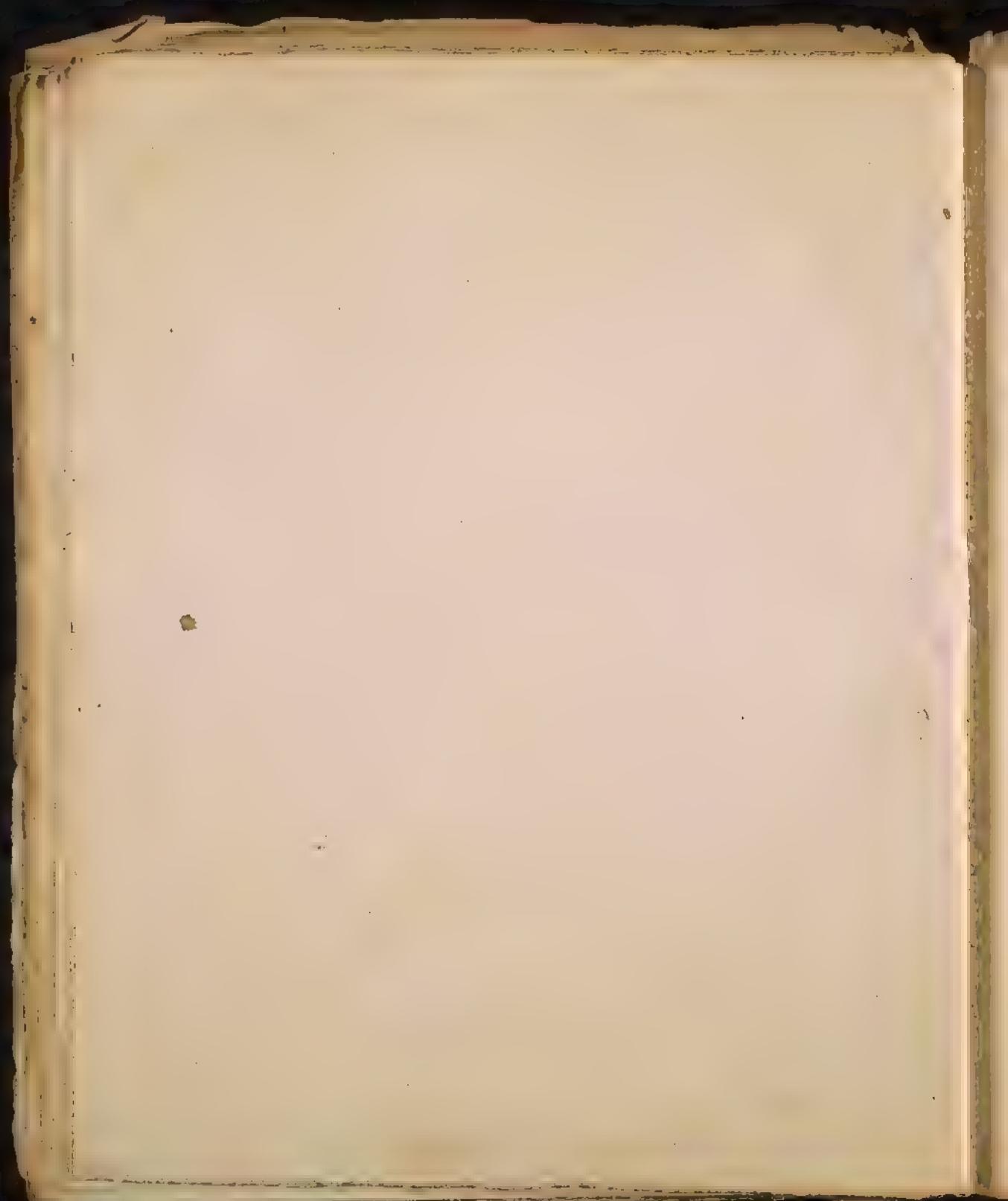
1 All bodies contain a certain portion of caloric, or the matter of heat in them.

2 These bodies are so constituted as to emit heat from impressions made upon

occurs likewise
V It ~~burns~~ ^{burns} in wood, the protracted
friction upon which, not only elicits
heat, but induces flame. It is thus
the Indians in this country kindle
their fires.

Chemical means of friction & impulsion.
 This is observed in a pair of Goldfinches under
 the shade of a laurel tree. Yet when placed
 from impulsion made even upon air,
 not to such a degree as an instant
 I called the "unrivalled bright" as
 I am accustomed to a ^{the} balance between
 the means of heat.

3 different substances possess a different
 susceptibility to impulsion, so that heat
 is elicited from them by ~~that~~^a greater or
 less force, and the heat is increased
 according to ~~this~~ the greater or less duration
 of those impusions. These facts being
 admitted I proceed to apply them by
 remarking
 1st That animal is greater in common



with the Substances²⁴ that have been
mentioned, contains a quantity of
caloric or matter of heat in it, which
it emits in common with those sub-
stances in consequence of impulsion
made upon the body, and thus produces
the sensation and other phenomena
of animal heat. In addition to the
facts that have been mentioned of
the production of heat from elements
towards light and ~~water~~^{the} the action of
impions upon the body, I shall mention
~~two~~^{one} facts from Dr Cart. The hand of a
man in good health was placed in a
bason of water at the temperature of
56°: - while his hand was



quiescent the heat of the water rose to
 65° that is 9° . ~~This~~ But when
 he moved his hand & fingers in the
 water it rose to 73 - that is 17° . Again
 he put his hand into a basin of water
 at 57° . In this situation it he filled
~~exercised~~ all its
~~muscles~~ muscles by an act of his will,
 without moving his hand. The water
 rose in this case ~~exercised~~
~~five degrees beyond its temperature~~
 at its quiescent state. Then we see heat
 produced as in the primum mobile
 by simple propagation. After the result
 of these experiments can I suppose Animal
 heat to be the effect of respiration only
 or the decomposition of air in the lungs?
 It would seem from all the facts that

V₄ are ~~that~~ certain evasions of the
mind of a stimulating nature? we find
the heat of the body increased by them, par-
-ticularly by ^{love,} Anger - and terror.

26

have been mentioned, that ^{a portion of} animal heat ~~like~~
animal life is the product of stimuli,
acting upon different parts of the body

Let us now inquire how far the ~~above~~
I have delivered sounds with the phenomena
of animal heat in the healthy & diseased
body; and how it is applicable to the pra-
ctica of physic - or the cure of diseases.

1 Is warm air a stimulus? we find the
heat of the external parts of the body increased
by its action upon them

2 Are aliments & drinks when taken into
the stomach of a stimulating nature? we fre-
quently observe the heat of the body to be increased
by them. This is most observable after a
full meal.

3 ~~Are~~ Wounds, light, and Odors stimulate the
senses? we observe the heat of the body to
be increased by their action upon them. V.

